PATENT SPECIFICATION (11) 1217739

1217739

DRAWINGS ATTACHED

(21) Application No. 19908/68 (22) Filed 26 April 1968
(31) Convention Application No. 698862 (32) Filed 23 May 1967
(31) Convention Application No. 711071 (32) Filed 21 Feb. 1968 in
(33) Belgium (BE)
(45) Complete Specification published 31 Dec. 1970
(51) International Classification F 16 l 19/00
(52) Index at acceptance F2G 24B3

(54) IMPROVEMENTS IN OR RELATING TO CONNECTORS FOR PIPES OR ELECTRICAL CABLES

(71) We, CLAUDE RALET and DANIEL RALET, subjects of the King of the Belgians, of 66, Boulevard Poincare, Brussels, Belgium, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a fluidtight connector for pipes and electrical cables, which is made in two parts, the first of which is a hollow nut and the second of which is a member extended forwardly by a sleeve which ends in an exterior male cone co-operating with a female cone of the nut.

The invention sets out to attain by simple means and with the aid of quite inexpensive components a series of fluidtight connectors which are easy to assemble. These connectors can be manufactured in various metal or synthetic materials including plastics materials, such as polypropylene, which have simultaneously the particularly desirable properties of strength and deformability.

According to the present invention there is provided a fluidtight connector for pipes and electrical cables which connector is made in two parts, the first of which is a hollow nut and the second of which is a member having a threaded part extended forwardly by a sleeve which is provided with longitudinal slots and which ends in an exterior male cone cooperating with an internal female cone in the hollow nut wherein the inner surface of the sleeve is provided in at least one place with a continuous integral unbroken ring the diameter of which is adapted to be reduced in view of thinned portions of the thickness of the wall of the sleeve and the local concentration of the thinned portions and so that the said ring is in direct contact with the pipe to form a fluid tight seal therebetween.

Specific embodiments of the invention will now be described by way of example with reference to the accompanying drawings, in which:—

Figures 1, 2 and 3 are cut away views in perspective of connectors embodying the invention for use with hard pipes,

Figures 4 and 5 are detail views,

Figures 6, 6A and 7 are detail and explanatory views, and

Figure 8 shows a connector for use with flexible pipes.

In Figure 1 there is shown a fluidtight connector for a hard pipe 1, for example a copper pipe. It is a question of the connector according to the first mode of embodiment that is, with a sleeve having an internal annular swelling. This connector consists of two components, the first of which is a hollow nut 2 and the second of which is a member 3 extended forwardly by a sleeve 4 which ends in a exterior male cone 5 co-operating with a female cone 6 of the hollow nut 2.

Longitudinal slots 7 are formed in the sleeve 4 along the generatrix lines and terminate before a thread 8. Owing to these slots it is possible to reduce the diameter of a sleeve.

Between the thread 8 and the point where the slots 7 begin, the sleeve is so formed that it has a continuous integral annular swelling or ring 9 towards the interior of the sleeve in conjunction with a reduction in the thickness of the wall of the sleeve.

With the assistance of the elasticity of the material, the tightening of the hollow nut 2 causes a contraction in the diameter of the annular swelling 9 and produces a fluidtight barrier between the outside of the pipe 1 or cable and the connector.

Means other than the annular swelling can be utilised to obtain the reduction in the diameter of a continuous section over the inner surface of the sleeve. Thus a second means consists of leaving a web at the bottom of the slots and in Figure 2 there is shown a connector in which this means has been applied.

It will be noticed in Figure 2 that the slots are in the form of deep groove 7^1 each having a bottom formed by a thin web 10 so that the sleeve has a smooth internal surface.

This means is closely linked with the formation of the body of the connector and therefore also of the sleeve and the thin webs in a material capable of flowing plastically under the influence of a high crushing force.

The choice of such a material in conjunction with retaining the general form shown in Figure 1, but with the addition of a thin web 10 in the slots, makes it possible to obtain a connector which is fluidtight, even if the annular swelling is dispensed with. In fact, when the nut is tightened, the thin web is subjected to a strong compression along its surface plane. It is deformed, folded up, and becomes fluid, changing in thickness locally, sometimes it even breaks, but in the event of breakage, experience has shown that this occurs without any detriment to the fluidtightness. It has even been observed that with polypropylene connectors having their thin web cracked before assembly, fluidtightness is achieved, as long as the fractures are simple cracks not interfering with the smooth nature of the inner surface of the sleeve.

This fluidtightness is accounted for by the state of high compression which causes sufficient plastic deformation to close up any breaks in continuity.

It has been established moreover that by providing a thin web at the bottom of the slots, an additional advantage is gained, not directly connected with fluidtightness, consisting of facilitating the intial assembly of the connectors. In fact, in the absence of the said web, it frequently occurs that the hollow nut is screwed up excessively and that the action of the cones in contact causes, assisted by time, a permanent contraction of the mouth of the sleeve. The presence of the thin web has the affect of producing a perceptible mechanical resistance when the hollow nut is screwed onto the sleeve when the component is assembled for sale. This enables the connector to be assembled tightly without fear of deforming the mouth of the sleeve.

It will likewise be observed in Figure 2 that the front of the clamp sections demarcated by the slots of the sleeve has a sharp edge 11 which is the intersection of a lead-in cone 12 with the outer cone 5. The lead-in cone 12 has the purpose of facilitating the insertion of the pipe into the connector, which is particularly useful when a connector is being set up, in which the clamp sections have already undergone a permanent deformation towards the inside resulting either from previous usage, or from being kept in stock with the nut excessively tightened. The sharp intersection 11 of the lead-in cone 12 with the outer cone 5 can also be seen in section in Figure 4.

Figure 3 shows an embodiment in which the fluidtightness arrangement of the thin web 10 at the bottom of the slots is combined with the annular swelling 9 according to Figure 1 in such a way as to obtain two fluidtight barriers in series on the outside of the pipe or cable.

It is advantageous, especially when the connectors are being used with smooth and hard pipes, to take precaution against the pipe slipping and its subsequent disconnection. For this purpose a portion of the connector is provided with corrugations or is roughened, and is applied with pressure against the pipe. When the hardness of the material of the pipe is similar to that of the connector these corrugations may be provided in the material of the connector. They are advantageously situated in the clamp sections of the member 3, just before the unbroken swelling 9.

When the material of the pipe is clearly harder than that of the connector, it is preferable to provide in the connector even harder inserts, which are capable of cutting into the material of the pipe. There can advantageously be provided in the inside of the forward end of the sleeve, steel inner jaws which are formed by fitting into the body of the clamp sections the anular portions 13 formed from a material harder than that of the pipe and provided on their inner surface with peripheral or helical ribs 14 with a small pitch. The helical ribs make it easier to remove the components from a mould in which they are made because they may be unscrewed from the mould (Figure 4).

Figure 5 represents in perspective the way in which the portions 13 are arranged. It can be seen that they form jaws which prevent the pipe slipping from the connector.

Another feature of the invention is to give the clamp sections, which the sleeve has between its slots, an inconstant radius of curvature. Behind the point where the clamp sections begin, this radius coincides with the radius of curvature of the sleeve. In front it is smaller than that of the sleeve and corresponds to that of the outer diameter of the pipe. The difference between these two radii is the radial play which the clamping has to take up. The more pronounced swelling of the clamp sections facilitates the registering of the sleeve and pipe which by clamping are put in contact.

Figures 6 and 6A show the disadvantage which there is in not varying the curvature of the clamp sections of the sleeve. In Figure 6 there is shown the connector (not clamped) with the front of the sleeve having an inside radius $r+e$ where r is the outside radius of the pipe and e the radial play between the pipe and the sleeve.

Figure 6A shows the connector clamped and it may be observed that the contact between the sleeve and pipe is imperfect and that a deformation through resturiction of the curvature of the clamp sections of the sleeve is necessary to obtain constant contact.

Figure 7 shows a connector provided with a more advantageous form of the front of its clamp sections. The centres of curvature of the four clamp sections lie or a circle of diameter 2e.

Figure 8 shows a connector for a flexible pipe 21 in which the core of the connector has a pipe holder 22 onto which the pipe is slipped.

This pipe holder is integral, or not integral, with the body of the connector, according to the nature of the case.

In the case of Figure 8, the arrangement of the members and the construction are the same as those of Figure 1. However, the embodiments according to Figures 2 and 3 are likewise applicable for a flexible pipe with a pipe holder.

Among the advantages of the invention there should be kept in mind, besides the low cost of the components employed, the ability to provide a range of standardised connectors in accordance with the requirements of Standards Institutions. The latter have decided to standardise a fixed series of outer diameters for pipes and to vary their wall thickness according to the nominal pressure.

By retaining as a guiding principle the fluidtight barrier on the outer surface of the tube, the number of connectors to be manufactured is limited to the series of standardised tubes. In the case of flexible pipes inner support tubes are attached to the connectors in accordance with the various thicknesses for each inner diameter standardised by the Standards Institution.

The construction having two fluid barriers in series, according to Figure 3, is particularly recommended. For the very common flexible pipes of small size, it is permissible to omit the rear fluid barrier formed by the internal annular swelling and to replace it, for certainty of operation, with the forward barrier which is obtained by making the support tube 22 integral with the body of the connector. In any case it is considered preferable not to depart from the construction with the thin web at the bottom of the slots, because the web adds to the fluidtightness.

WHAT WE CLAIM IS:—

1. A fluidtight connector for pipes and electrical cables which connector is made in two parts, the first of which is a hollow nut and the second of which is a member having a threaded part and extended forwardly by a sleeve which is provided with longitudinal slots and which ends in an exterior male cone cooperating with an internal female cone in the hollow nut wherein the inner surface of the sleeve is provided in at least one place with a continuous integral unbroken ring the diameter of which is adapted to be reduced in view of thinned portions of the thickness of the wall of the sleeve and the local concentration of the thinned portions and so that the said ring is in direct contact with the pipe to form a fluid tight seal therebetween.

2. A connector as claimed in claim 1, wherein for the formation of the unbroken ring, there is provided between the point where the slots begin and the threaded part of the member a more thinly walled portion in the form of an annular swelling projecting towards the inside of the sleeve.

3. A connector as claimed in claim 1, wherein for the formation of the unbroken ring, the sleeve is smooth on the inside and has on the outside slots in the form of deep grooves whose bottoms are formed by a thin web of material and the material of which the connector is made is capable of flowing plastically.

4. A connector as claimed in claims 2 and 3, wherein the fluidtightness arrangement of the thin web at the bottom of the slots is combined with the annular swelling in such a way as to obtain two fluidtight barriers in series on the outside of the pipe or cable.

5. A connector as claimed in any one of claims 1 to 4 wherein there is provided at the forward end of the sleeve an inner cone intended to facilitate the introduction of the pipe or cable into the sleeve and a sharp edge at the intersection of the cones at the forward end of the sleeve.

6. A connector as claimed in any one of claims 1 to 5, wherein the inside of the clamp sections, which are demarcated on the sleeve by the slots or grooves with a thin-web, is provided with ribs or with roughened portions intended to prevent the pipe from slipping from the connector.

7. A connector according to claim 6, wherein the ribs are formed by annular segmented portions set into the plastics material of the connector, said annular portions having peripheral sharp edges on their inner face and being made of a material which is harder than the pipe material.

8. A connector as claimed in any one of claims 1 to 7, wherein the forward end of each clamp section of the sleeve is made with a smaller radius of curvature than that of the cylinder which they form at their point of origin, the radius of curvature of these clamp components corresponding to the sections in the compressed state.

9. A connector as claimed in any one of claims 1 to 8, wherein in the case of flexible pipes the connector comprises a supporting pipe holder inserted inside the pipe.

10. A fluidtight connector for pipes substantially as hereinbefore described with reference to and as illustrated in Figures 1, 2, 3 or 8 of the accompanying drawings.

11. A fluidtight connector for pipes substantially as hereinbefore described with reference to and as illustrated in Figures 1, 2

3 or 8 when modified by Figure 4 and 5 of the accompanying drawings.

12. A fluidtight connector for pipes substantially as hereinbefore described with reference to and as illustrated in Figures 1, 2, 3 or 8 when modified by Figure 7 of the accompanying drawings.

13. A fluidtight connector for pipes substantially as hereinbefore described with reference to and as illustrated in Figures 1, 2, 3 or 8 when modified by Figures 4, 5 and 7 of the accompanying drawings.

CLAUDE RALET AND DANIEL RALET,
Per: Boult, Wade & Tennant,
112, Hatton Garden, London, E.C.1.
Chartered Patent Agents.

Printed for Her Majesty's Stationery Office, by the Courier Press, Leamington Spa, 1970.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1217739 COMPLETE SPECIFICATION
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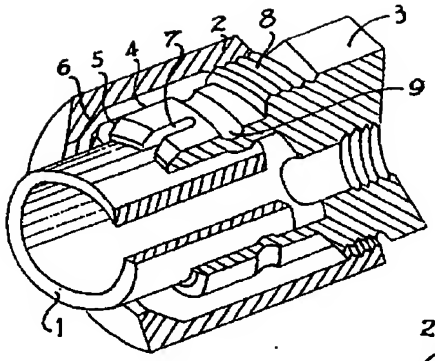
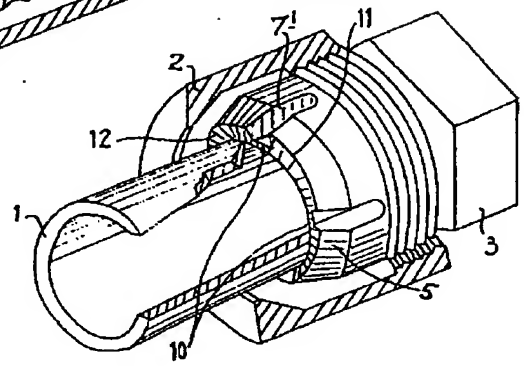


FIG.1.

FIG.2.



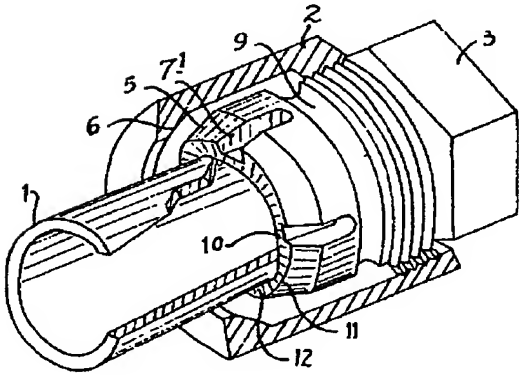


FIG.3.

1217739 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

FIG.4.

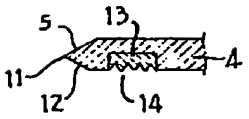
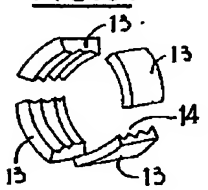


FIG.5.



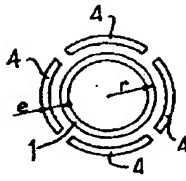


FIG.6.

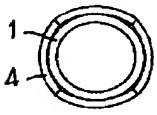


FIG.6A.

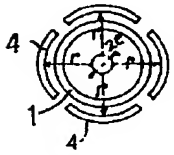


FIG.7.

FIG.8.